

REMARKS

Reconsideration of the present application in view of the above amendments and the following remarks is respectfully requested.

I. Status of the Claims

Claims 1-29 and 31-71 are pending in this application. Claims 14-24, 36-38, and 45-71 have been withdrawn from consideration. In the Office Action mailed on July 21, 2003, claims 1-13 were indicated as being allowed, claims 25-29, 31-35 and 39-44 were rejected, and claims 39 and 40 were indicated as being allowable. Claim 25 has been amended.

II. Rejection Under 35 U.S.C. § 103

The Examiner rejected claims 25-29, 31-35 and 41-44 under 35 U.S.C. §103 as being unpatentable over admitted prior art described on pages 1-6 of the application and shown in Figure 1 of the application, which admitted prior art is described in detail in P.B. Chu, J.T. Chen, R. Yeh, G. Lin, J.C.P Huang, B.A. Warneke, and K.S.J. Pister, "Controlled Pulse-Etching with Xenon Difluoride", *Transducers* 1997, Chicago IL, 16-19 June 1997 (hereinafter the "Chu Reference") in view of United States Patent No. 6,409,876 B1 to McQuarrie et al. and United States Patent No. 5,470,390 to Nishikawa et al. Specifically, the Examiner stated that the Chu Reference teaches an etching apparatus comprising an etching chamber for receiving a sample to be etched, wherein the etching chamber is in fluid communication with a roughing pump, a source of etching gas generated from a non-gaseous material (XeF_2), and an expansion chamber in selective fluid communication with the source and the etching chamber. The Examiner further stated that the Chu Reference fails to teach the expansion chamber being in fluid communication with a vacuum pump. The Examiner also stated that McQuarrie et al. teaches an etching

apparatus having an expansion chamber in fluid communication with a XeF_2 source chamber, an etch chamber and a roughing pump assembly such that the expansion chamber may be evacuated by the roughing pump either through the etching chamber or directly through a bypass. The Examiner concluded that it would have been obvious to implement the bypass as taught by McQuarrie et al. in the apparatus of the Chu Reference in order to be able to directly evacuate the contents of the expansion chamber.

The Examiner also stated that neither the Chu Reference nor McQuarrie et al. teach a second expansion chamber as required by claim 25. The Examiner asserts that Nishikawa et al. teaches an apparatus for dynamic blending of a semiconductor fluid (SiH_4) with a carrier gas that includes a buffer tank that is used as a backup source. The Examiner concluded that it would have been obvious to provide a backup source system as taught by Nishikawa et al. in the apparatus taught by the Chu Reference in view of McQuarrie et al. In addition, as an alternative to Nishikawa et al., the Examiner stated that the addition of a second expansion chamber would be a mere duplication of parts having no patentable significance.

The Applicants have amended claim 25 to further require that “said first fluid connection be[] independent from said etching chamber and said source of said etching gas” and that “said second fluid connection be[] independent from said etching chamber and said source of said etching gas” such that the first expansion chamber and the second expansion chamber may be selectively evacuated either through the etching chamber or through said first or second fluid connections, respectively, “exclusive of and independent from said source of said etching gas.” Such a configuration is important because Applicants’ invention is designed to be utilized as a pulse etching system rather than a continuous etching system as is the case with McQuarrie et al. Specifically, in Applicants’ system as set forth in amended claim 25, processing may begin with each expansion chamber being filled to a known pressure with process gas by, for example,

allowing the gas to sublime from the source. One of the expansion chambers may then be opened to the etching chamber to start the first etching cycle. At the end of the etching cycle, the vacuum pumping source, such as a roughing pump, is able to evacuate the etching chamber and draw any remaining gas from the expansion chamber through the etching chamber. Then, the expansion chamber just used may be closed off from the etching chamber and the second expansion chamber may be opened to the etching chamber to immediately start the next etching cycle. At the same time, i.e., during the ongoing etching cycle, the first expansion chamber may be prepared for refill. In particular, the first expansion chamber may be directly evacuated using a fluid connection to a vacuum pumping source, such as the roughing pump. The direct fluid connection is independent, meaning it does not include either the etching chamber or the source of the process gas. In other words, only the expansion chamber will be exposed to the reduced pressure created by the vacuum pumping source. This ability to evacuate only the expansion chamber (and not the etching chamber and/or the source of gas) is important for at least two reasons. First, the etching chamber is in use in the ongoing etching cycle and thus cannot be exposed to the reduced pressure. Second, exposing the source of etching gas to the reduced pressure would cause the nongaseous material used to generate the etching gas to be evacuated away and wasted, such as by causing solid XeF_2 crystals to be unnecessarily sublimated away, and thus be unavailable for refilling the expansion chambers for subsequent etching cycles.

In contrast, McQuarrie et al. does not describe an etching apparatus having a fluid connection between a vacuum pumping source and an expansion chamber that is independent from the etching chamber and the source of the etching gas such that the expansion chamber may be evacuated exclusive of and independently from the source of the etching gas as required by amended claim 25. In McQuarrie et al., the bypass 28 connects the roughing pump 14 to both the reservoir 18 and source chamber 16, and there is no mechanism provided for sealing off the

source chamber 16 so that only reservoir 18 can be evacuated. As indicated at column 2, lines 20-25, bypass 28 is provided for the express purpose of connecting the roughing pump 14 to the source chamber 16 in order to pump the source chamber 16 down to sublimation pressure (to convert the XeF₂ crystals to XeF₂ gas to fill reservoir 18). This is the case because McQuarrie et al. describes a continuous etching system rather than a pulse etching system. In a continuous etching system, one continuous etch cycle is used to etch the specimen. Specifically, a reservoir such as reservoir 18 is connected to a gas source (i.e., source chamber 16 pumped down to sublimation pressure by roughing pump 14) and the gas is flowed, using a flow controller connected to the reservoir, into an etching chamber at a predetermined rate for a predetermined time. Numerous pulsed etching cycles, as in the case of the present invention, are not used in a continuous etching system. Because numerous pulsed etching cycles are not used in a continuous etching system, it is not necessary, nor is it possible in the case of McQuarrie et al., to be able to independently evacuate the reservoir 18 without simultaneously evacuating the source chamber 16. Accordingly, Applicants respectfully submit that amended claim 25 is allowable over the cited references. In addition, because claims 25-29, 31-35 and 39-44 depend, either directly or indirectly, from claim 25, Applicants respectfully submit that they are likewise allowable over the cited references.

Furthermore, it is well settled that to establish a prima case of obviousness, one must show “some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references.” Tec Air, Inc. v. Denso Manufacturing Michigan Inc., 192 F.3d 1353, 1359-60 (Fed. Cir. 1999), *quoting* In re Fine, 837 F.2d 1071, 1074 (Fed. Cir. 1988). There is, however, “no suggestion to combine ... if a reference teaches away from its combination with another reference.” Id. at 1360. A reference teaches away from an invention “when a person of ordinary

skill ... would be led in a direction divergent from the path that was taken by the applicant.” Tec Air, 192 F.3d at 1360 (Fed. Cir. 1999), *quoting In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994).

As noted above, the ability to independently evacuate the expansion chamber and not the source of etching gas is important in the present invention because exposing the source of etching gas to the reduced pressure would evacuate away and waste the nongaseous material used to generate the etching gas (such as by causing solid XeF₂ crystals to be unnecessarily sublimated away), thereby making it unavailable for refilling the expansion chambers for subsequent etching cycles. McQuarrie et al. *teaches away* from a fluid connection between a vacuum pumping source and an expansion chamber that is independent from the source of the etching gas because it specifically teaches a system having a bypass 28 the stated purpose of which is to connect the roughing pump 14 to the source chamber 16 to pump the source chamber 16 down to the sublimation pressure (as discussed above, the roughing pump 14 cannot be used to independently evacuate the reservoir 18). In other words, McQuarrie et al. clearly leads “in a direction divergent from the path that was taken by the applicant.” Because McQuarrie et al. *teaches away* from the present invention as claimed in claim 25, there is no motivation or suggestion to combine McQuarrie et al. with the other cited references. As a result, it is not proper to use McQuarrie et al. in rejecting amended claim 25 under 35 U.S.C. §103, and the Examiner’s rejection based thereon should be withdrawn.

In addition, the Examiner, in the Response to Arguments section of the July 21, 2003 Office Action, states that United States Patent No. 6,290,864 B1 to Patel et al., like McQuarrie et al., teaches an expansion chamber that is in direct fluid communication with a vacuum pump. Applicants assume from this response that the Examiner is of the view that claim 25 would be obvious based on the Chu Reference in view of Patel et al. Applicants respectfully disagree.

The Federal Circuit has long held that “[w]hen a rejection depends on a combination of prior art references, there must be some teaching, suggestion, or motivation to combine the references.” In re Rouffet, 149 F.3d 1350, 1355. Applicants acknowledge that the Chu Reference describes an etching apparatus including an etching chamber in fluid communication with a roughing pump, a source of etching gas generated from a non-gaseous material (XeF_2), and an expansion chamber in fluid communication with the source and the etching chamber. Applicants also acknowledge that Patel et al. describes an etching apparatus including a source chamber in fluid communication with an expansion chamber that in turn is in fluid communication with an etching chamber, wherein the expansion chamber is in direct fluid communication with a vacuum pump. There is, however, no teaching, suggestion or motivation to combine the Chu reference with Patel et al. to create an etching apparatus as claimed in amended claim 25 that has a source of etching gas, first and second expansion chambers, and an etching chamber wherein (i) the etching chamber has a fluid connection to a vacuum pumping source so that either the first or second expansion chamber may be evacuated through the etching chamber; and (ii) both the first and second expansion chamber have a fluid connection to a vacuum pumping source that is independent from the source and the etching chamber. On this specific subject, the Federal Circuit has stated:

‘[V]irtually all inventions are combinations of old elements.’ Therefore an examiner may often find every element of a claimed invention in the prior art. If identification of each claimed element in the prior art were sufficient to negate patentability, very few patents would ever issue. Furthermore, rejecting patents solely by finding prior art corollaries for the claimed elements would permit an examiner to use the claimed invention itself as a blueprint for piecing together elements in the prior art to defeat the patentability of the claimed invention. Such an approach would be ‘an illogical and inappropriate process by which to determine patentability.’

In re Rouffet, 149 F.3d at 1357 (citations omitted). Moreover, “[t]o prevent the use of hindsight based on the invention to defeat patentability of the invention, [the Federal Circuit] requires the

examiner to show a motivation to combine the references that create the case of obviousness.”

Id. The Chu Reference describes only a single path for evacuating its expansion chamber, namely through the expansion chamber (the roughing pump is connected only to the etching chamber), which is sufficient for the modes of operation contemplated by the Chu Reference. The Chu Reference provides no motivation to add another path, i.e., a direct path, for evacuating the expansion chamber. Similarly, Patel et al. describes only a single path for evacuating its expansion chamber, namely through a direct connection to its vacuum pump, which is sufficient for the modes of operation contemplated by Patel et al. Patel et al. provides no motivation to add another path, i.e., through the etching chamber, for evacuating the expansion chamber. Accordingly, Applicants respectfully submit that a rejection of amended claim 25 under 35 U.S.C. §103 based on the Chu Reference in view of Patel et al. would be improper, as doing so would involve the use of hindsight using the present invention as a “blueprint for piecing together elements in the prior art.”

Finally, amended claim 25 requires first and second expansion chambers wherein each is in fluid communication with the source of etching gas and the etching chamber and wherein each also has a separate fluid connection to a vacuum pumping source. The Examiner, in rejecting claim 25, stated neither the Chu Reference nor McQuarrie et al. teach a second expansion chamber as required by claim 25. The Examiner concluded, however, that claim 25 would have been obvious based on the Chu Reference in view of McQuarrie et al. and Nishikawa et al. because Nishikawa et al. teaches an apparatus for dynamic blending of a semiconductor fluid (SiH_4) with a carrier gas that includes a buffer tank that is used as a backup source. In addition, as an alternative to Nishikawa et al., the Examiner stated that the addition of a second expansion chamber would be a mere duplication of parts having no patentable significance.

In summary, the novelty and the benefits of claim 25 are primarily based upon the ability to independently evacuate the various chambers while each is not in fluid contact with any other parts of a multiple expansion system. The previously cited art does not teach or suggest the capability of independent evacuation of the various chambers. In McQuarrie the expansion chamber can not be connected to roughing pump independently of the source. In Chu the expansion chamber can not be connected to the roughing pump independently of the process chamber. In Patel the process chamber can not be connected to the roughing pump independently of the expansion chamber.

With respect to the rejection based on Nishikawa et al., that reference merely describes a buffer tank 21 which restrains or relieves the pressure of the mixed gas coming from a mixing chamber 13 and supplies the mixed gas to each of a plurality of semiconductor manufacturing units 4, and in one embodiment (Fig. 3), the fact that a second such buffer tank 21 can be provided as a backup in the event of a malfunction or abnormality (see Nishikawa et al., Column 9, lines 49-60). Nishikawa et al. does not describe first and second expansion chambers wherein each is in fluid communication with the source of etching gas and the etching chamber and wherein each also has a separate fluid connection to a vacuum pumping source for purposes of enabling the expansion chambers to be either directly evacuated or evacuated through the etching chamber. As a result, Applicants submit that the mere teaching of the use of a backup tank in the event of a malfunction or abnormality in Nishikawa et al. would not render obvious the apparatus recited in amended claim 25 which contemplates more than merely the provision of a backup expansion chamber for use in the event of a malfunction or abnormality. In other words, Nishikawa et al. provides no teaching, suggestion or motivation that would render obvious amended claim 25. With respect to the duplication of parts rejection, Applicants submit that such a rejection is only proper where a piece of prior art exists that shows all of the claimed

elements but for the duplication of the part or parts in question. As demonstrated herein, that is clearly not the case here as the Examiner needed to combine the teachings of at least two references before then relying on the duplication of parts rejection to fill in the still missing claim limitations. As a result, Applicants submit that the rejections based on Nishikawa et al. and the duplication of parts doctrine should be withdrawn.

CONCLUSION

Based on the foregoing remarks, Applicants respectfully submit that claims 1-13 and 25-29, 31-35 and 39-44 are in condition for allowance.

If a telephone conference would facilitate prosecution of this application in any way, the Examiner is invited to contact the undersigned at the number provided.

Respectfully submitted,

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